How Colour Blindness Affects Psychological Colour Perceptions

Does experiencing colour blindness cause different psychological colour associations when compared to the general population?

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Abstract

As of 2011, colour blind individuals currently make up approximately 10% of the Canadian population (Wong, 2011). Despite their large population, they are routinely overlooked as consumers and face unique challenges. These challenges largely result from the fact that those who experience colour blindness cannot perceive colour the same way as the general population. Information that is meant to draw attention may appear invisible, and emotional cues stemming from colour can be missed. This study investigated the relationship between colour blindness and psychological colour perception in order to determine whether they are the same as those with normal colour vision. An online survey was conducted which asked participants to disclose their vision status, as well as provide ratings for several colour images based on emotional adjectives. Results were collected from 32 normal vision and 36 colour vision deficient participants across different age groups and sexes. Analysis of the data concluded that while overall emotional colour associations were the same between both groups, they were not as strong in participants who experienced colour blindness. More research is needed in order to determine why these weaker associations occur, as well as if specific types of colour blindness play a role in associations.

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Introduction

Colour blindness (or colour vision deficiency) is a condition caused by damage or lack of retinal photoreceptors that results in the affected individual not being able to perceive certain colours. Protanopia and deuteranopia are the most common forms of colour blindness, which are caused by damage or lack of retinal photoreceptors respectively (Wong, 2011). Colour blindness is usually the result of a genetic abnormality in the X chromosome, resulting in more men than women being diagnosed with the condition. About 8% of men and 0.5% of women of Northern European descent experience some form of colour blindness (Wong, 2011). According to CTV News (2015), an estimated 2.5 million Canadians have some form of a colour vision deficiency.

Despite comprising nearly 1 in 10 of the Western population, colour blind individuals are often overlooked when it comes to design. If information is conveyed solely using colour, it can be entirely missed by a colour blind individual. Certain colour combinations, such as red text on a black background, can completely disappear (Kaufman-Scarborough, 2001). Additionally, colour emotion plays a significant role in product design in order to manipulate the consumer into associating a product or advertising campaign with specific emotions and feelings. However, because individuals suffering from a colour vision deficiency cannot always perceive colour the same way as the general population, these cues may also be entirely overlooked. The purpose of this research is to establish whether or not individuals who experience colour blindness have different psychological colour associations when compared to people with normal colour vision, and to explore how this information can be used in order to increase accessibility in design.

Literature Review

Several research studies have investigated the important role of colour in consumer decision-making. As a tool, colour has been utilized in this way by ancient Chinese, Egyptians and Indians (Singh & Srivastava, 2011). In their book 'Color and Light in Man-made Environments', Frank and Rudolf Mahnke (1987) state: "Colors and light are major factors in manmade environments; their impact influences man's psychological reactions and physiological well-being. It is no longer valid to assume that the only role of light and color is to provide adequate illumination and a pleasant visual environment." However, little attention has been placed on how individuals who are colour blind perceive this stimulus and the different effect it may have on their psyche.

As related to marketing, the utilization of certain colours has the ability to influence moods, emotions, feelings, sensations, and perception. In their 2011 study, Nayanika Singh and S. K. Srivastava provide a comprehensive overview of the role colour plays in the psychology of marketing. They assert that colour is one of the most important factors to consider in a successful marketing campaign, and incorrect use of it can result in its failure. Their study details the significance of specific colours from both a daily-life and a marketing standpoint. It also provides several examples of marketing campaigns that have been either successful or unsuccessful due to their use of colour. However, there is no discussion of how colour blind individuals may perceive these emotions differently, and how this may impact a marketing campaign, or how different types of colour blindness could cause different reactions. Additionally, the information is presented from a strictly Western perspective. There is no mention of how cultural and geographic differences can influence the way colours are perceived.

As mentioned previously, the associations the general population may have with specific colours are different across different geographic regions. For example, Mubeen Aslam (2006) notes that while white is associated with purity and happiness in Anglo-Saxon countries, across southeast Asia it is associated with death and mourning and is a common colour choice for funerals and related services. Throughout the journal article,

Aslam notes the importance of colour in corporate branding and consumer decision making, and how improper applications can result in product misperception. This article also focuses on one of the shortcomings of the previous article: how colour associations differ based on culture. By breaking down the study into several geographic areas, Aslam is able to highlight the differences between colour associations within them. However, these geographic areas are all located either within Europe or southeast Asia. There is a considerable lack of research into associations among the Middle East, Africa, and South America. Aslam also addresses the lack of research in approaching this topic from the perspective of a colour blind individual in his conclusion, but there is no attempt to fill this gap with data within the article.

Dr. Carol Kaufman-Scarborough is one of the few individuals who has conducted research into how the improper use of colour can negatively impact colour blind consumers. She has published two notable articles detailing this issue further: *Seeing through the eyes of the color-deficient shopper* and *Accessible advertising for visually-disabled persons*. In these articles, Kaufman-Scarborough details the struggles that colour blind consumers experience when shopping or viewing advertisements, and she brings up suggestions on how they can be overcome. She notes that colour blindness can be onset from or come with the use of certain medications, illness, or age. Both articles contain interviews with individuals who are colour blind themselves. Important information includes how colourblind individuals often struggle to “learn” colour and often have to memorize specific colour cues. Additionally, information that is delivered solely by colour can be entirely missed if an improper colour combination is used. For example, red lettering on green or black backgrounds can entirely disappear, which could pose a considerable risk if used for an emergency exit sign (Kaufman-Scarborough, 2001). While detailed, Kaufman-Scarborough’s research does not explore how these learned colour cues may differ and what impact they may have on emotional responses.

There was a clear consensus among academics that colour plays a significant role in the success of a marketing campaign. Research into the target audience is needed in order to establish what colours will be the most effective for eliciting the desired emotional response from consumers. However, little research has been conducted on how colour blind individuals may experience a different emotional response than the

general population, and what those responses may be. This paper aims to find out what these emotional responses are, how they are different, and how marketers can use this information to their advantage.

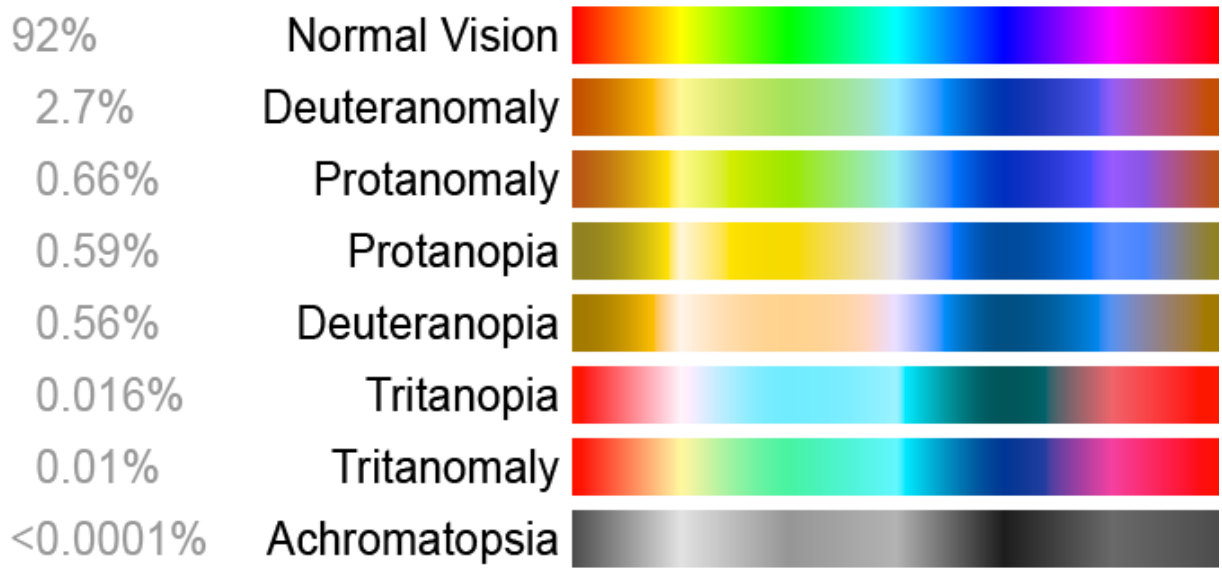


Fig. 1: *Comparison of how colour may appear to those affected with colour blindness, and their respective occurance rate among the population.*

Methodology

The goal of this research study was to gather information on how colour blind people perceive colour emotions and whether there is a significant difference between their perception and that of the general population. Primary quantitative research was conducted and data that was collected was descriptive in nature. This approach is the most suitable option for this study as it allows for observations to be gathered without intervention.

Data for this study was collected with an online survey created and distributed by a Google Form. Survey participants were recruited through three groups; a student mailing list, a Facebook group, and a Reddit forum. The mailing list was made up of students enrolled in the Graphic Communications Management program at Ryerson University, and the survey link was distributed via email with permission from the professor of the thesis course. The mailing list primarily consisted of those who had colour vision and constituted most of the normal colour vision responses. The Facebook ("Color Blindness / Deficiency Awareness") and Reddit ("r/colorblind: For people who see the world differently") groups were both public support and discussion groups for people who are colour blind. The survey was shared within these two groups along with a brief summary of the study's purpose. Reception to the survey was positive, with one individual in the Facebook group stating, "Anytime the color normal world wants to improve their service to the CVD community, I appreciate it highly."

The survey was divided into two parts; demographic background information and colour association questions. In the first section, participants were given four questions. They were asked to provide their consent for their responses to be used as part of an undergraduate thesis, their age, their sex, and to disclose whether or not, to their knowledge, they suffered from a colour vision deficiency. In order to comply with the university's ethics board guidelines regarding medical information, it should be noted that participants were not asked to disclose any specific diagnosis (ex. protanopia, tritanopia). For the second section, participants were presented with an image of one of the

following colours: red, orange, yellow, green, blue, purple, pink, white, or black. Beneath this image were nine questions asking participants to rate their perception of the colour. The concept of colour perception cannot be directly measured, but it was operationalized by asking participants to rate choices using a Likert scale. Each scale presented the user with two words that were antonyms, and participants were to rate which word they more closely associated with the colour presented above. These word pairs were as follows:

- Happiness or Sadness
- Peaceful or Aggressive
- Natural or Synthetic
- Warm or Cold
- Clean or Dirty
- Busy or Simple
- Trust or Distrust
- High Quality or Low Quality
- Masculine or Feminine

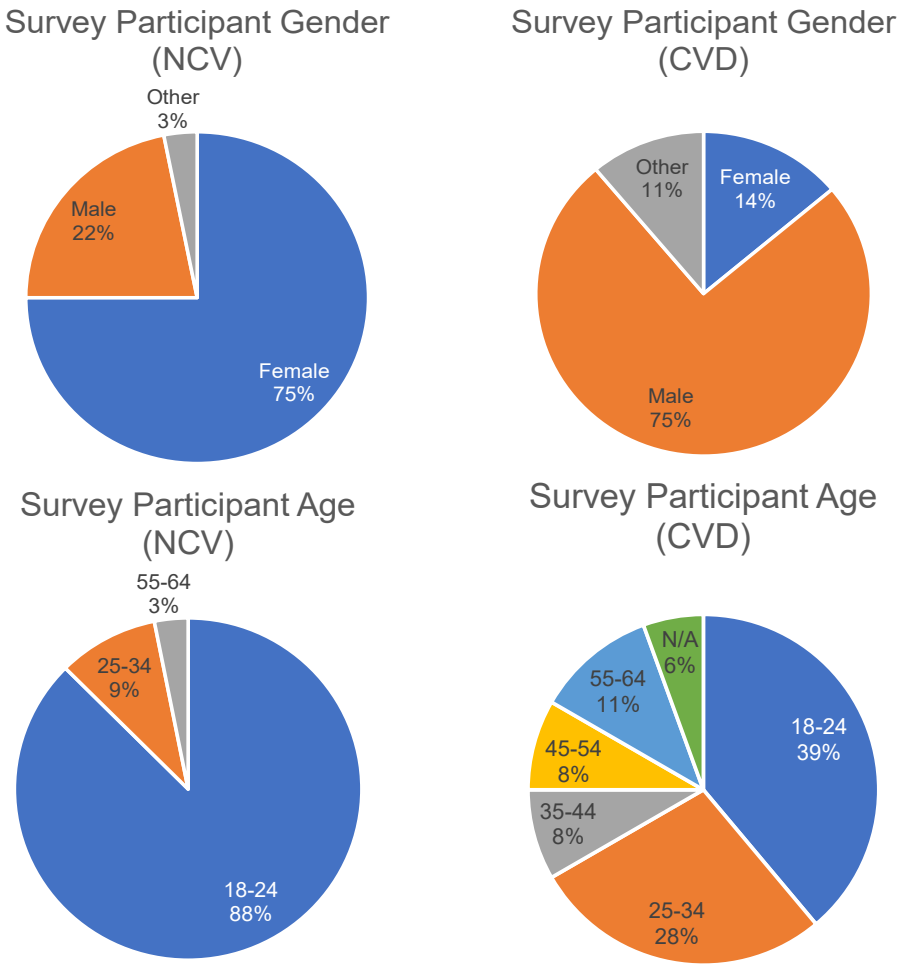
Before analysis began, the dataset was reviewed for any missing data or outliers. After its integrity was verified, the response data was transferred from the automatically collected Google Sheet into an organized and divided Excel document. Data was divided using separate sheets and tables in order to make examination easier. Data was sectioned based on whether the participants were colourblind or had normal vision, and by each pair of associations listed. Markers were used on 2D line charts to visually represent the collected responses. Pie charts were created for the demographic questions.

Fig. 2: *An example of a colour prompt question taken from the online survey.*

Results

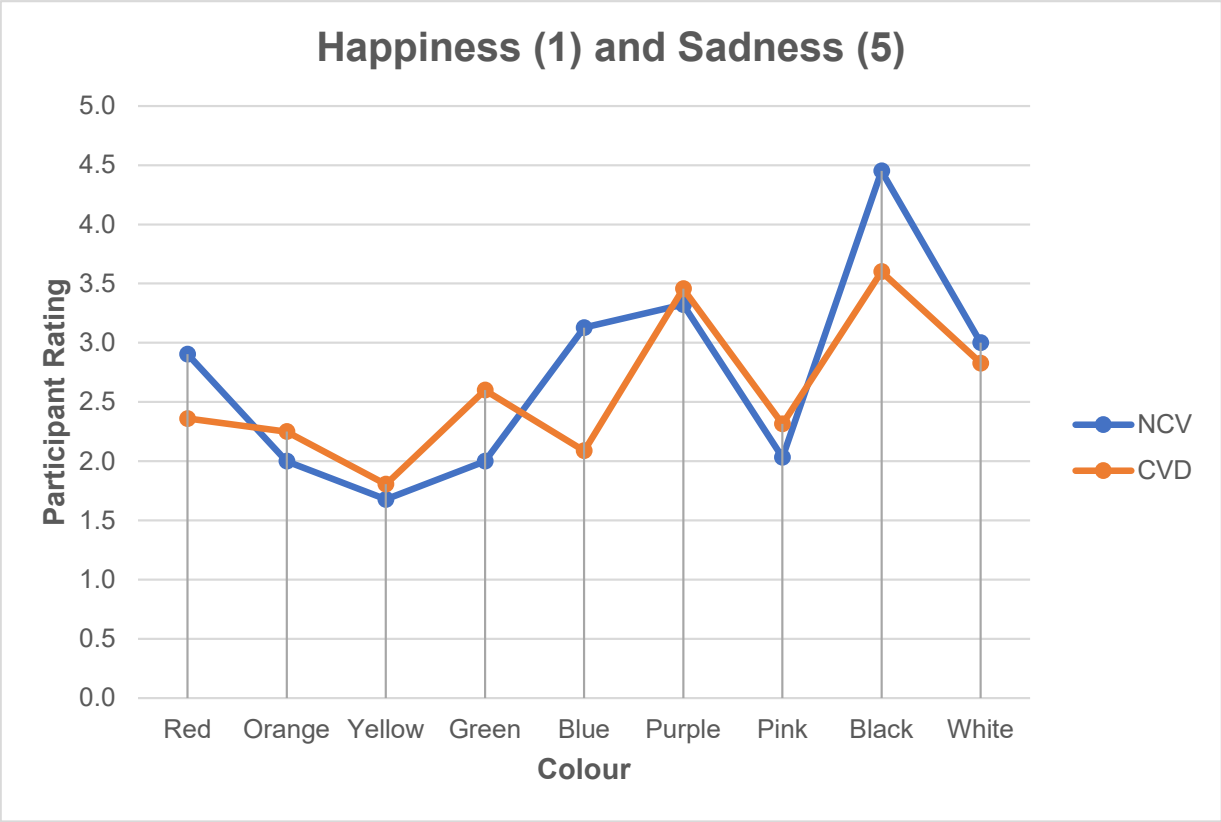
Participant Background

In total, there were 68 responses to the online survey; 32 came from individuals with normal colour vision (NCV) and 36 from individuals with a colour vision deficiency (CVD). Of the participants with NCV, 24 (75%) were female, 8 were male (22%) and 1 (3%) chose “Other/Prefer not to say”. There were 28 (88%) NCV participants between the ages of 18-24, 3 (9%) were 25-34 and 1 (3%) was 55-64. Of the CVD participants 27 (75%) were male, 5 (14%) were female and 4 (11%) chose “Other/Prefer not to say”. Ages were more varied amongst CVD participants: 14 (39%) were 18-24, 10 (28%) were 25-34, 3 (8%) were 35-44, 3 (8%) were 45-54, 4 (11%) were 55-64, and 2 (6%) chose “Prefer not to say”.



Happiness and Sadness

Both NCV and CVD participants associated the colour yellow the most with happiness and the colour black most with sadness. NCV participants had a significantly stronger association between the colour black and sadness when compared to CVD participants, but both groups rated it the saddest amongst other colours. CVD participants rated blue to be mildly associated with happiness, while NCV participants found it mildly associated with sadness. CVD participants rated green as a neutral colour which they equally associated with happiness and sadness, while NCV participants found it to be mildly associated with happiness.

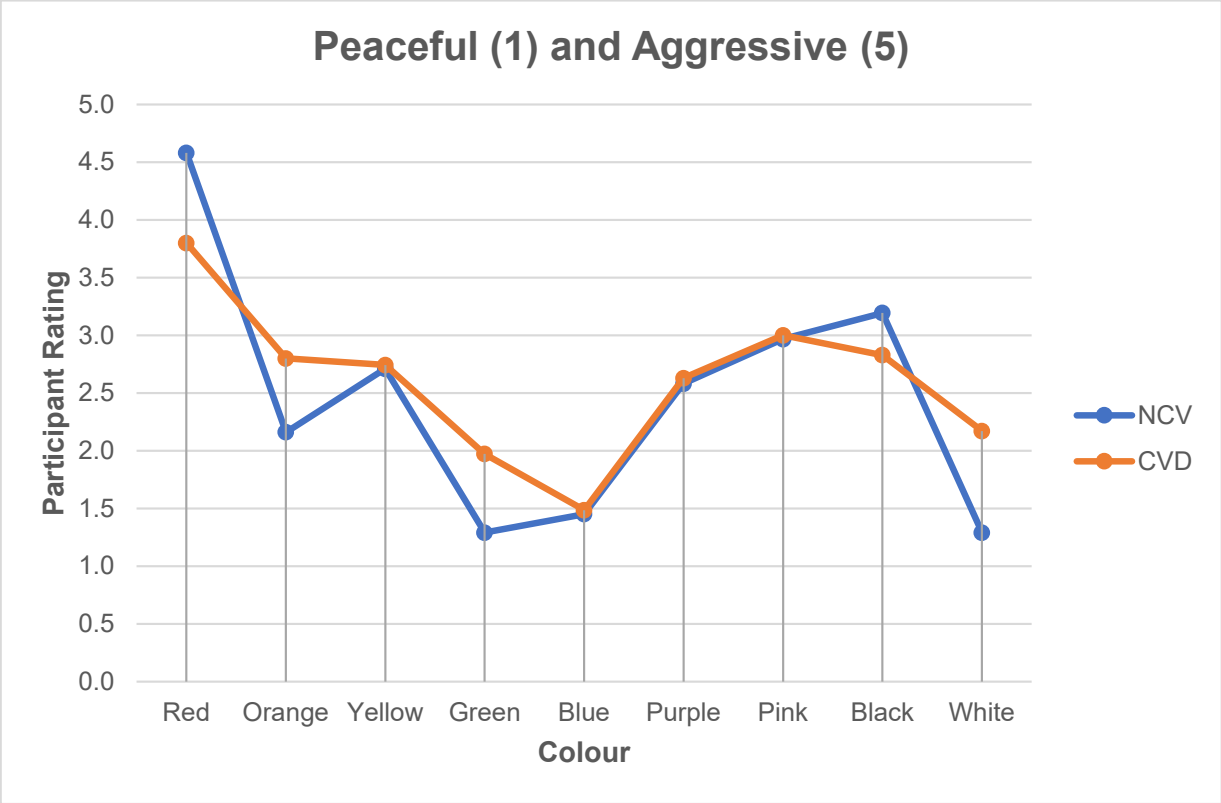


Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	2.90	2.00	1.68	2.00	3.13	3.32	2.03	4.45	3.00
CVD	2.36	2.25	1.81	2.60	2.09	3.46	2.31	3.60	2.83

Peaceful and Aggressive

Red was considered the most aggressive colour by both groups, but more so by NCV participants. Green was the colour most associated with peace, followed closely by white. While CVD participants found both of those colours to be peaceful, their associations were not as strong as NCV participants. Blue was also rated as one of the most peaceful colours, with responses between both groups being nearly identical. Responses were also very similar between both groups for the colours yellow, purple, and pink.

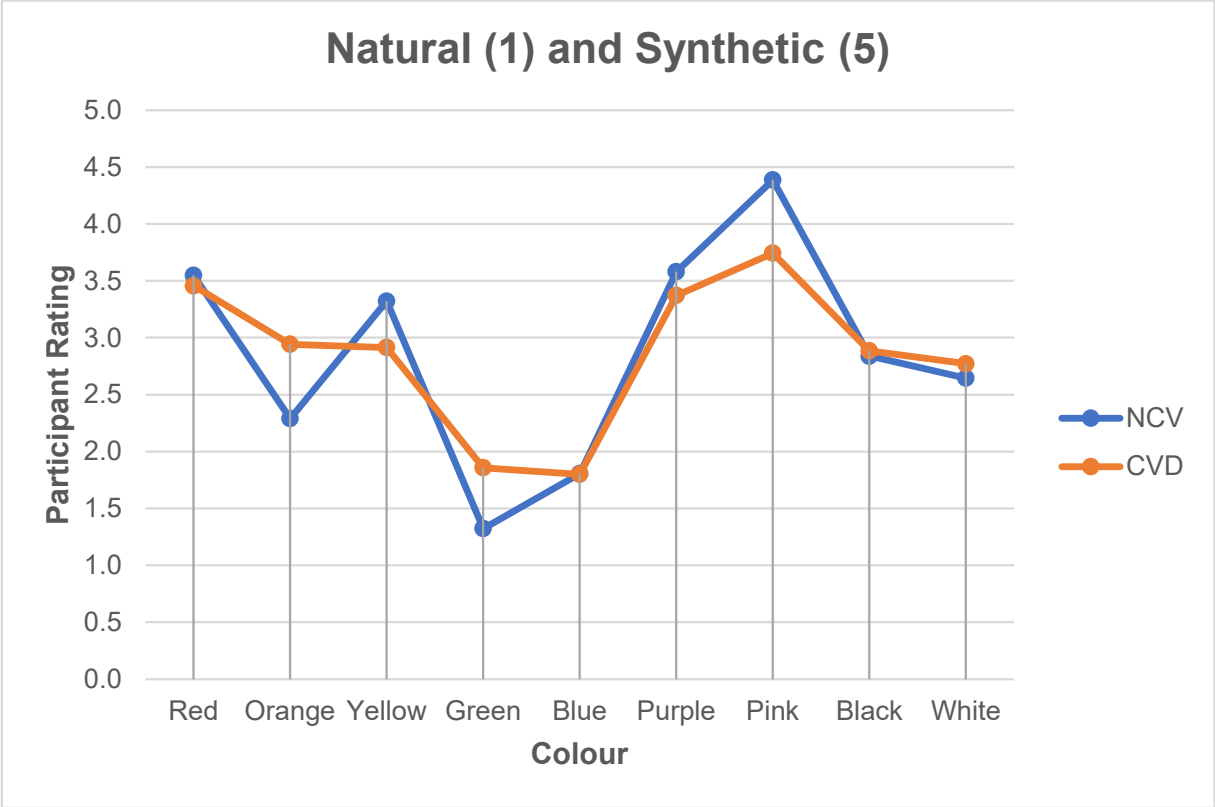


Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	4.58	2.16	2.71	1.29	1.45	2.58	2.97	3.19	1.29
CVD	3.80	2.80	2.74	1.97	1.49	2.63	3.00	2.83	2.17

Natural and Synthetic

Pink was the most synthetic colour according to both groups, but NCV participants rated the association stronger compared to CVD participants. While NCV participants found green to be the most natural colour and blue the second most, CVD participants found blue to be the most natural and green the second most. The rating given to the colour blue by both groups was nearly identical. NCV participants also found orange to be neutral, while CVD participants mildly associated it with synthetic. Ratings for red, blue, purple, black, and white were similar between both groups.

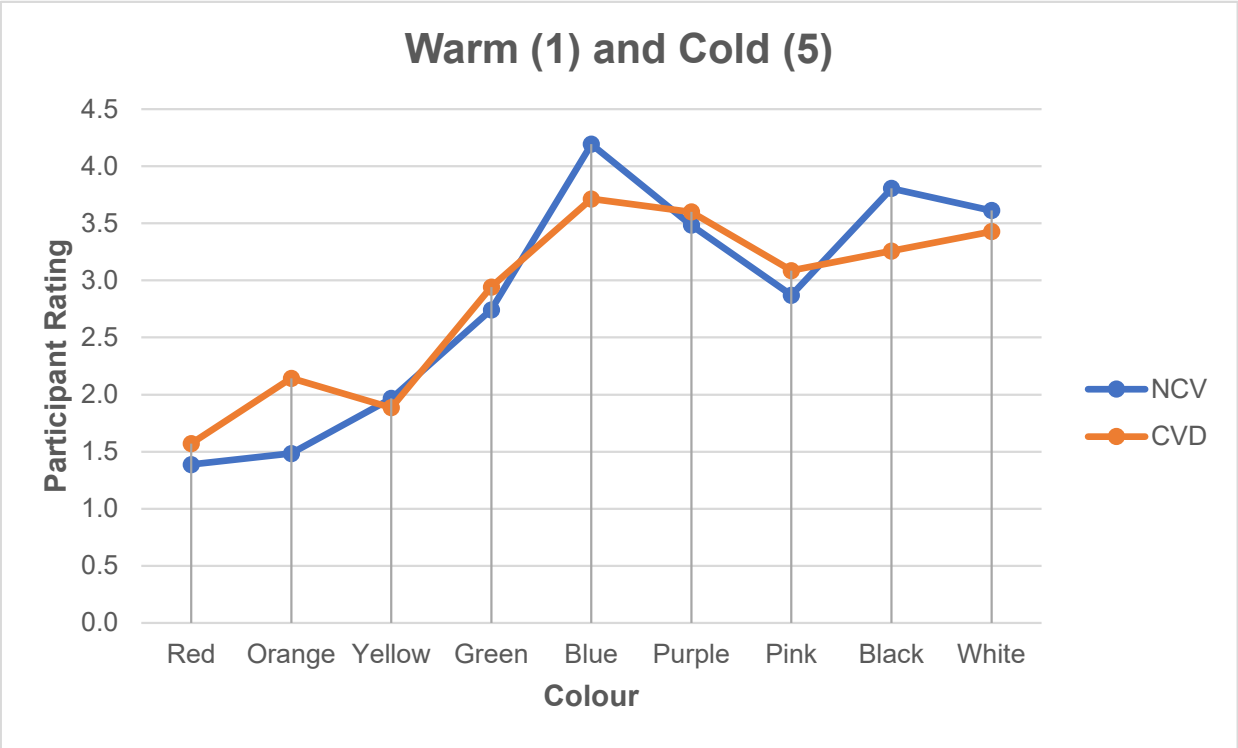


Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	3.55	2.29	3.32	1.32	1.81	3.58	4.39	2.84	2.65
CVD	3.46	2.94	2.91	1.86	1.80	3.37	3.74	2.89	2.77

Warm and Cold

NCV and CVD participants both found blue to be the coldest colour and red the warmest. CVD participants rated purple to be the second coolest colour, while NCV participants rated black the second coolest. Both groups rated white as the third coolest. Interestingly, CVD participants rated orange to be less warm than yellow despite it being closer in hue to red than yellow. Pink and green were both rated similarly among both groups despite being very different in hue from each other.

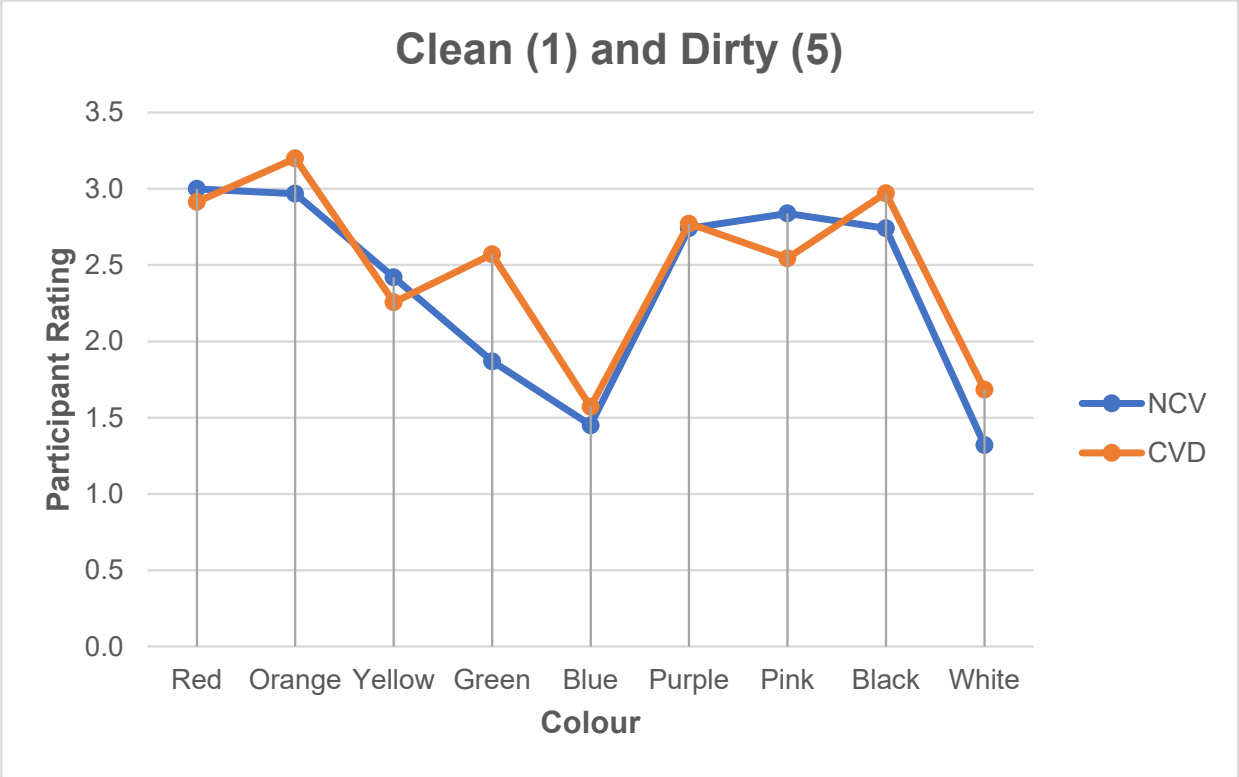


Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	1.39	1.48	1.97	2.74	4.19	3.48	2.87	3.81	3.61
CVD	1.57	2.14	1.89	2.94	3.71	3.60	3.09	3.26	3.43

Clean and Dirty

Numeric responses to this prompt were very similar to the previous one, warm and cold. Both groups found white and blue to be the cleanest colours . Red and black were associated neutrally by both. There was a considerable difference in opinion on the colour green. While both groups associated with cleanliness, NCV participants found this association considerably stronger than CVD participants. No colours were strongly associated with dirty within either group, only mildly associated.

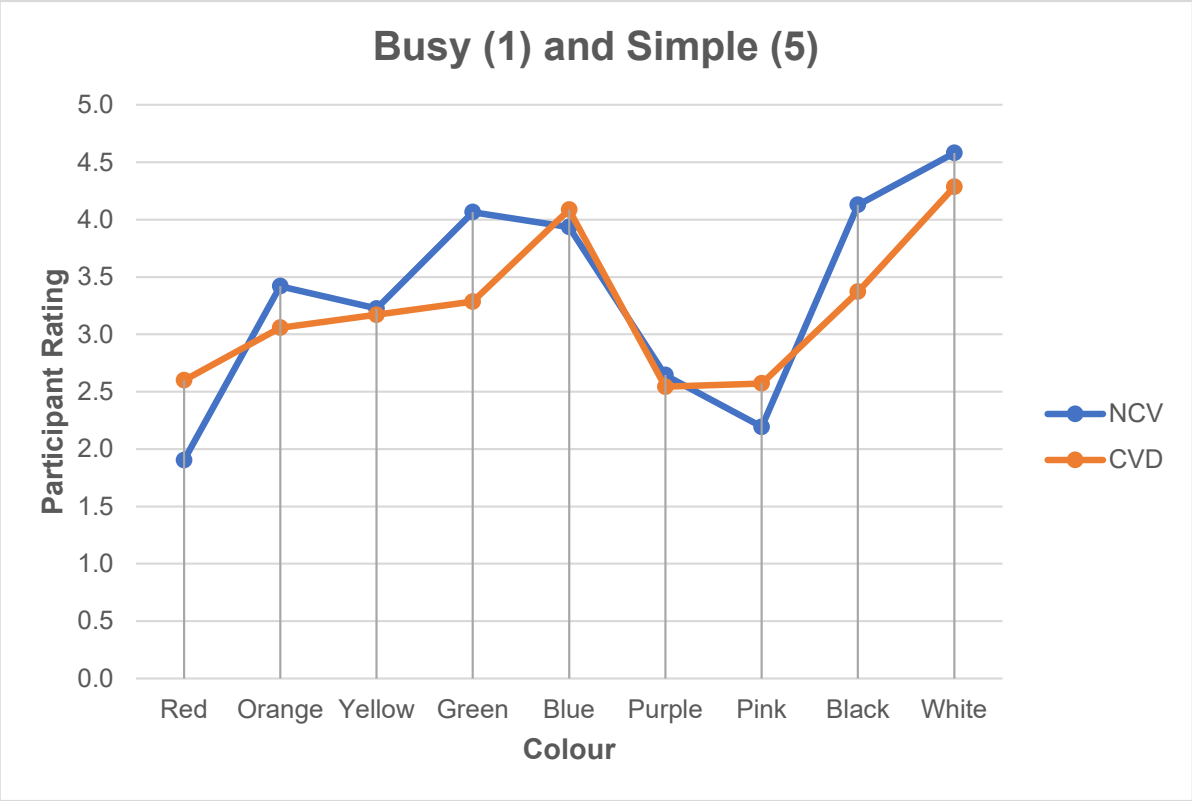


Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	3.00	2.97	2.42	1.87	1.45	2.74	2.84	2.74	1.32
CVD	2.91	3.20	2.26	2.57	1.57	2.77	2.55	2.97	1.69

Busy and Simple

NCV and CVD participants both found white to be the simplest colour, despite the "colour" white actually having the most wavelengths reflected into one's eyes. Black, green, and blue were rated the second, third, and fourth simplest respectively among NCV participants, although scores for all three were very similar. CVD participants rated blue as the second simplest with scores between both groups being almost identical despite its higher ranking. Red was considered the busiest colour by NCV participants, CVD participants also found red to be a busy colour, but their association was not as strong. Pink and purple were also considered busy colours by both groups.

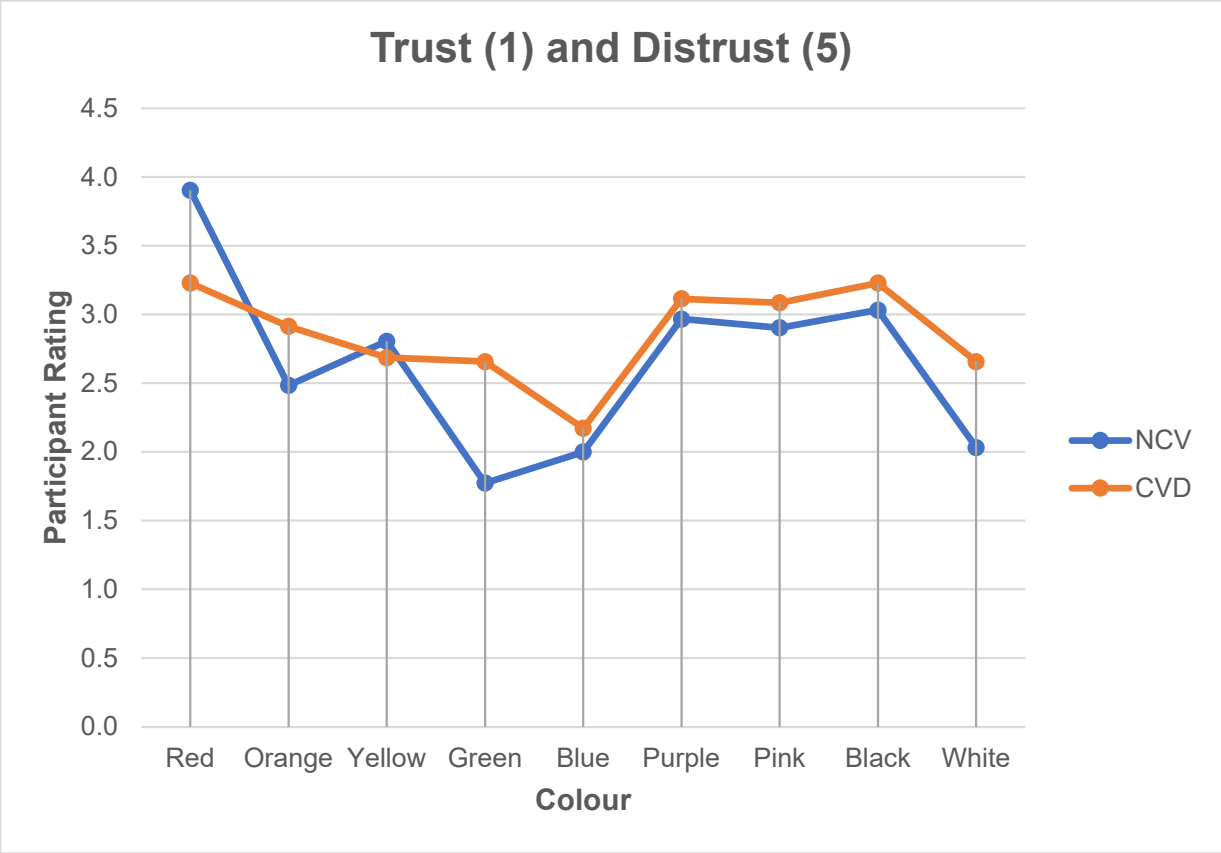


Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	1.90	3.42	3.23	4.06	3.94	2.65	2.19	4.13	4.58
CVD	2.60	3.06	3.17	3.29	4.09	2.54	2.57	3.37	4.29

Trust and Distrust

This prompt showcased a considerable difference in opinion between NCV and CVD participants. Red was strongly associated with distrust among NCV participants, while CVD participants did not find this association as strong. Similar results were evident for the colour green, which was rated the most trustworthy with NCV participants but not CVD participants. Instead, they associated blue the most with trust. White was also rated as a trustworthy colour, again less so by CVD participants. Yellow, purple, pink, and black were all rated neutrally among both groups.

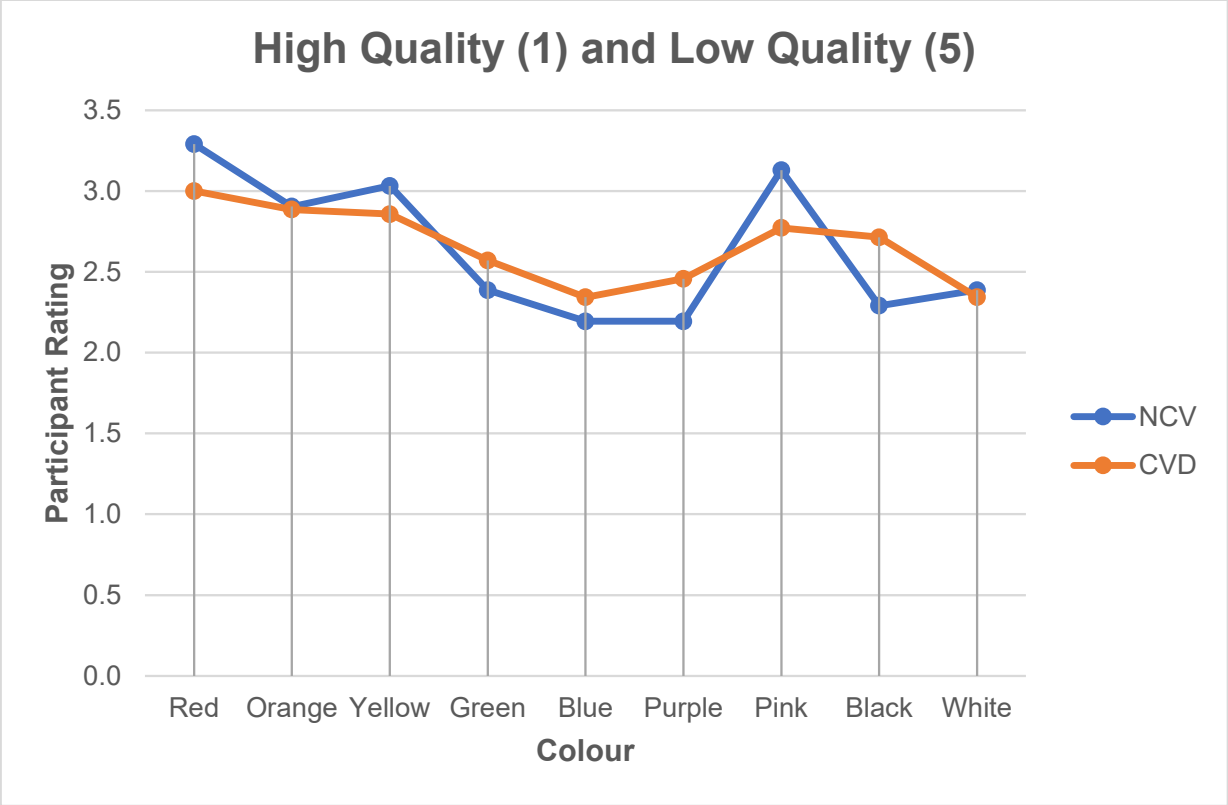


Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	3.90	2.48	2.81	1.77	2.00	2.97	2.90	3.03	2.03
CVD	3.23	2.91	2.69	2.66	2.17	3.11	3.09	3.23	2.66

High Quality and Low Quality

Each colour for this prompt was either rated as neutral or was more associated with high quality. No average colour scores for CVD participants for these questions went above 3. Purple, blue and black had the strongest association with high quality. Red and pink were the only colours associated with low quality among NCV participants, albeit very slight.

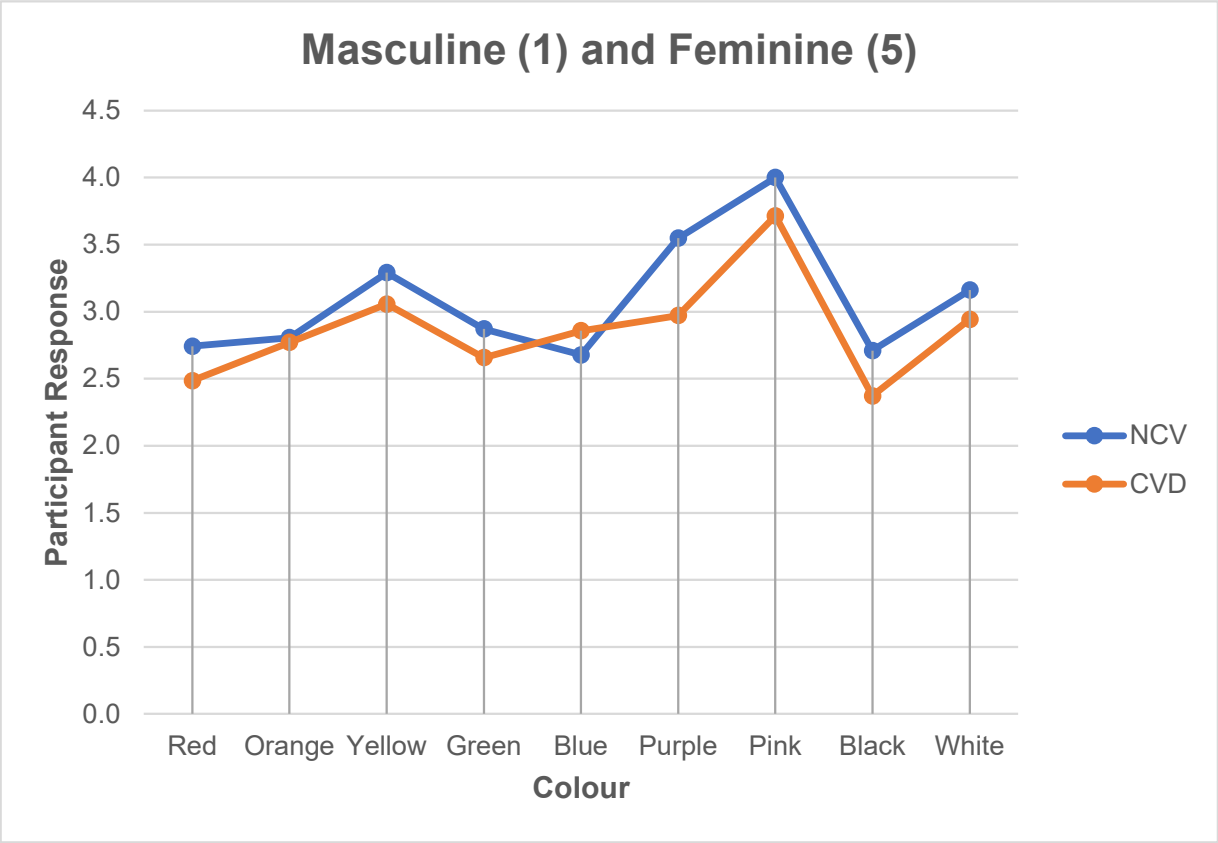


Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	3.29	2.90	3.03	2.39	2.19	2.19	3.13	2.29	2.39
CVD	3.00	2.89	2.86	2.57	2.34	2.46	2.77	2.71	2.34

Masculine and Feminine

Pink was rated as the most feminine colour by both NCV and CVD groups. Purple was also found feminine by NCV participants, but neutral by CVD participants. Most other colours were associated as neutral for both groups. Red and black were the colours most associated with masculinity. Contrary to other prompts, CVD participants found these associations stronger compared to NCV participants.



Averages

	Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
NCV	2.74	2.81	3.29	2.87	2.68	3.55	4.00	2.71	3.16
CVD	2.49	2.77	3.06	2.66	2.86	2.97	3.71	2.37	2.94

Discussion

Results from this research indicate that people who have a colour vision deficiency do, in fact, have different psychological colour perceptions than those who do not. While general colour associations were largely similar among both groups, participants with a colour vision deficiency were more likely to have weaker associations. For example, participants with normal colour vision reported the colour red as very aggressive, whereas participants with colour vision deficiencies also found it aggressive, but to a lesser degree. Additionally, results from the demographic section support the theory that men are more likely than women to experience colour blindness, as there were significantly more colour blind men than women counted as respondents.

Additionally, many colour prompts elicited responses that were nearly identical between both groups.. However, there was no clear correlation between a specific colour and having closer averages. Even colours like black and white, which were perceived as nearly identical by both groups, had averages that were both nearly identical (<0.05) and very different (>0.5) depending on the prompt provided.

These results should be taken into account when considering how to design a marketing campaign or product. Knowing that certain groups of people may not respond to certain colours as strongly as the general population can help companies understand why their campaign may not have been as effective as they had anticipated. This insight can also aid designers during the design process, by providing them with additional information on how colour emotions can be perceived. For example, while green may be considered the simplest colour by normal colour vision participants, this association was not as strong with colour vision deficiency participants. Instead designers may wish to utilize blue in their design instead, which had a very strong association for both normal colour and colour vision deficiency participants.

Due to research constraints, these results have some limitations. In order to protect confidentiality, participants were only asked if they experienced a colour vision

deficiency but not what type of colour vision deficiency they experienced. There are three types of colour vision deficiencies and each one causes the individual to perceive colours differently. Because of this distinction, there was no way to conclude whether different types of colour vision deficiencies caused different associations, only whether colour vision deficiencies caused different associations as a whole. Additionally, the sample size used included less than 70 individuals and was limited to people who were part of specific groups, such as student groups or those specific to colour blindness. Because of this limitation , the reliability of the data is negatively impacted. For future research, inquiring what colour vision deficiency participants are affected by, and gathering a larger sample size, will increase the reliability of the data. Nonetheless, the data is still valid for the purpose of analysis and still provides valuable insight into the perception of the world by the colour blind.

Conclusion

The purpose of this paper was to investigate whether or not individuals who are affected with a colour vision deficiency perceive psychological colour associations in a different way than the general population. Based on the research that was conducted, it can be concluded that people with a colour vision deficiency do indeed perceive colour emotions differently. Most individuals with a colour vision deficiency had similar associations to those of the general population, but to a lesser degree. While some colours presented nearly identical associations between both groups, others had a considerable difference in severity. Research was limited by the inability to filter results by specific types of colour blindness and by a limited sample size, but still provided valuable insight into a topic that is rarely covered. Future studies should avoid these limitations by prompting participants to provide their type of colour vision deficiency and by recruiting more participants from a wider variety of groups. This research can be used to further the understanding of how colour deficient consumers perceive advertising campaigns and product colour in order to create more inclusive designs.

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Appendix

Raw Data

NCV: Happiness (1) and Sadness (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
3	1	3	2	5	4	2	5	5
3	3	1	3	3	2	1	5	1
3	2	1	3	5	3	1	3	3
2	2	2	2	2	4	2	5	2
3	2	1	1	5	3	3	5	3
3	2	1	3	5	4	3	5	3
4	2	1	1	5	3	1	5	3
3	2	1	1	4	3	2	5	2
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4	1	1	1	1	1	1	5	1
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4	2	3	1	2	4	2	5	2
3	2	2	3	5	3	3	5	3
2	3	3	3	3	3	3	4	3
3	1	2	2	2	3	1	5	2
2	2	1	2	2	4	2	4	4
2	2	2	4	5	2	1	5	5
3	1	3	1	1	5	3	5	2

NCV: Peaceful (1) and Aggresive (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
5	2	5	2	1	1	2	1	1
5	3	2	2	2	2	3	4	1
5	2	1	1	1	1	1	3	1
4	2	5	2	2	2	3	3	2
5	1	1	1	1	1	4	5	1
5	2	2	1	1	3	4	1	1
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5	3	2	1	1	3	4	4	2
3	1	1	1	1	1	2	3	1
5	2	2	1	2	3	1	5	1
5	3	4	3	2	4	4	3	1
5	1	3	1	1	4	4	3	1
5	2	2	1	1	4	2	1	1
4	3	4	1	1	2	3	5	2
5	1	5	1	1	4	5	5	1
4	3	3	1	3	3	2	1	2
5	1	3	1	1	4	5	3	1
5	5	3	1	3	3	3	5	1
4	2	3	1	1	1	2	2	1
4	2	1	1	3	3	3	3	2
5	2	3	1	1	2	1	4	1
5	2	3	2	2	3	4	4	1
3	3	3	2	2	4	3	3	3
4	2	3	2	1	2	4	2	1
4	3	2	2	2	2	2	4	2
5	2	4	1	2	2	4	5	1
4	1	5	1	1	4	5	1	1

NCV: Natural (1) and Synthetic (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
1	2	5	1	1	5	4	5	5
3	2	1	1	2	2	4	1	1
3	3	1	1	1	3	4	3	1
5	2	5	4	4	5	5	3	3
5	2	4	1	1	3	5	5	3
4	2	2	1	1	2	4	3	1
4	3	4	1	2	3	5	1	3
4	4	4	1	1	4	4	5	5
2	2	3	1	3	5	4	5	5
3	1	2	1	1	2	5	2	5
4	3	2	1	3	3	4	4	3
4	4	3	1	3	4	4	3	2
3	1	1	1	1	3	3	1	1
3	1	1	1	1	3	5	1	1
4	3	3	2	2	3	4	3	1
4	1	4	1	1	4	5	1	5
2	1	5	2	2	4	5	2	4
5	2	3	1	1	4	4	1	5
5	1	5	1	1	3	5	5	1
3	2	3	1	2	4	5	3	5
5	2	5	1	1	2	5	1	3
3	3	3	1	3	5	5	3	3
3	4	5	2	2	3	4	2	3
5	3	2	1	4	5	5	1	1
2	1	4	1	2	5	5	4	2
3	2	3	1	2	4	3	3	1
3	4	3	2	3	4	3	2	3
4	3	5	1	1	4	5	4	1
4	4	4	2	2	4	4	4	2
3	2	4	1	1	4	4	5	1
4	1	4	3	1	2	5	2	2

NCV: Warm (1) and Cold (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
1	2	4	3	4	4	5	5	5
2	1	3	4	4	2	2	5	3
1	1	1	3	5	5	3	3	3
1	1	1	4	4	5	2	3	3
1	2	2	1	5	3	4	5	3
1	1	1	3	4	4	2	5	3
1	1	1	3	5	4	2	5	3
1	1	1	2	4	4	2	5	3
1	2	1	2	5	4	3	3	3
1	1	3	1	4	2	2	5	5
2	1	2	2	4	4	3	3	3
2	2	3	3	4	3	3	3	4
2	1	1	2	3	2	2	3	2
1	1	1	2	5	4	3	5	5
1	1	1	3	5	3	1	3	3
1	1	2	2	4	4	4	3	5
1	2		2	4	4	4	4	5
4	1	2	2	2	4	2	4	4
1	1	2	3	5	3	2	1	5
3	3	3	3	3	3	3	3	5
1	1	3	3	5	4	3	3	3
1	1	1	3	5	5	5	5	3
1	1	2	4	5	5	4	5	5
2	4	1	3	5	3	3	3	5
1	2	3	3	5	2	3	4	3
1	1	3	3	5	3	3	3	3
1	3	3	3	3	3	3	2	3
2	1	2	2	4	3	3	4	3
2	2	2	4	4	4	4	4	3
1	2	2	4	5	3	2	5	5
1	1	2	3	1	2	2	4	1

NCV: Clean (1) and Dirty (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
3	2	1	2	1	3	5	1	1
2	1	2	3	2	2	3	3	1
3	3	1	1	1	3	3	5	1
4	4	2	2	1	3	3	4	1
3	3	3	1	1	3	3	1	1
2	3	2	1	1	3	3	5	1
4	3	1	1	1	2	2	3	2
3	4	3	2	1	3	3	3	1
3	3	4	2	3	3	3	1	1
5	2	1	1	1	4	4	1	1
3	3	1	1	2	3	3	4	1
3	4	3	1	2	2	3	3	3
1	3	1	3	1	2	1	3	1
5	3	1	3	1	3	2	5	1
3	3	3	3	2	3	3	1	1
2	2	2	2	1	1	1	1	1
4	4	4	2	2	5	4	1	1
2	4	2	1	1	1	1	1	1
3	3	1	1	1	4	3	3	1
3	3	3	3	3	3	3	3	3
3	3	2	4	1	3	3	1	1
3	3	3	3	1	3	3	5	1
2	3	4	2	1	2	3	1	1
3	2	3	1	2	3	3	3	1
3	2	4	2	1	3	4	4	1
3	3	4	2	2	3	3	4	1
3	4	2	2	3	3	3	3	3
2	3	3	1	1	2	2	3	1
2	4	2	2	2	2	2	2	4
5	4	4	1	1	3	2	5	1
3	1	3	2	1	2	4	2	1

NCV: Busy (1) and Simple (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
1	4	4	4	4	1	2	5	5
5	4	4	3	4	3	2	5	5
1	2	4	5	5	3	3	5	5
1	4	4	4	2	1	1	5	4
1	3	4	5	5	2	1	5	5
2	4	4	4	4	3	2	5	5
1	3	2	4	4	4	1	5	5
2	2	3	4	5	4	3	5	5
2	3	4	4	4	2	2	5	5
5	5	4	5	4	1	2	5	5
2	4	4	4	4	2	2	5	5
2	3	4	5	4	3	2	2	5
1	3	3	1	3	2	1	3	3
1	4	5	4	5	2	2	3	5
2	3	2	4	4	3	2	4	5
2	2	5	5	1	2	5	5	5
3	5	1	5	5	2	2	5	5
2	4	3	5	5	3	2	5	5
1	5	5	4	5	2	1	3	5
1	4	3	3	3	2	1	3	3
1	4	2	5	4	3	1	5	5
3	3	3	3	3	3	3	3	3
1	2	1	2	4	4	4	5	5
2	2	3	5	2	3	5	3	3
1	5	2	4	5	4	2	2	4
1	3	3	3	4	3	3	4	5
3	3	4	4	3	3	3	4	3
5	4	2	5	4	2	1	5	5
1	4	2	4	4	4	4	4	4
1	2	3	5	5	4	1	1	5
2	3	3	4	4	2	2	4	5

NCV: Trust (1) and Distrust (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
5	4	3	1	1	3	3	1	1
4	3	2	2	3	3	3	4	1
3	3	1	1	3	1	2	3	1
4	2	2	2	2	5	4	2	2
5	2	4	1	1	3	3	3	1
5	2	4	1	2	3	3	3	1
4	3	2	1	2	2	3	3	3
4	2	2	1	1	2	2	2	1
4	4	4	1	2	4	3	3	3
5	1	2	2	2	4	4	2	1
4	2	3	3	2	2	3	3	3
3	3	3	2	3	3	3	3	3
3	2	1	1	1	2	2	3	2
5	2	3	2	3	4	2	5	1
3	3	3	3	3	3	3	3	3
4	1	2	1	1	3	3	3	3
3	1	4	2	1	5	2	2	2
4	2	2	1	1	1	2	1	3
5	1	3	1	4	4	3	5	1
3	3	3	3	3	3	3	3	3
5	3	3	1	1	1	3	1	1
3	3	3	3	3	3	3	3	3
4	3	4	2	3	3	3	3	1
3	3	3	1	3	3	3	3	3
3	2	4	2	3	4	2	4	2
3	3	3	3	1	3	3	4	3
3	4	3	2	1	4	3	3	3
4	2	2	1	2	2	3	4	1
3	3	2	2	2	3	2	4	4
5	4	3	3	1	2	4	4	1
5	1	4	3	1	4	5	4	2

NCV: High Quality (1) and Low Quality (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
5	3	3	3	1	2	4	1	1
3	3	3	3	3	3	2	4	1
3	3	3	1	3	1	2	3	3
4	3	3	2	2	2	5	2	2
3	5	5	3	3	1	5	1	1
2	3	3	2	2	2	4	1	1
2	3	2	1	1	2	3	3	3
3	3	3	3	2	2	3	1	1
3	3	4	3	3	3	3	2	4
5	2	2	3	2	3	4	1	1
3	3	3	3	2	1	4	2	3
3	3	3	3	3	2	3	2	3
3	2	1	2	1	2	2	2	2
3	3	2	3	3	3	3	3	2
3	3	3	3	3	3	3	3	3
3	2	3	3	3	2	1	1	3
4	2	4	2	1	2	2	1	1
5	2	4	1	1	1	3	1	1
1	1	1	1	3	4	1	5	5
3	3	3	3	3	3	3	3	3
3	3	3	1	1	1	5	3	3
3	3	3	3	1	1	1	5	3
4	4	4	3	2	3	4	2	2
4	3	3	1	3	4	5	3	3
4	2	4	3	2	2	4	3	2
3	3	4	3	1	3	4	2	1
3	4	3	3	3	3	2	3	3
4	3	2	2	3	2	1	1	1
3	3	3	2	2	2	2	3	4
4	4	3	3	2	1	4	2	5
3	3	4	2	3	2	5	2	3

NCV: Masculine (1) and Feminine (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
2	2	3	3	3	4	5	1	3
3	3	3	3	3	3	3	3	3
1	3	3	3	1	5	5	3	3
4	4	3	2	3	4	3	3	3
3	3	3	3	3	3	3	3	3
3	3	3	3	3	1	4	3	3
3	3	3	3	3	3	3	3	3
2	3	3	3	4	4	5	1	3
3	3	3	3	3	3	3	3	3
5	1	5	2	1	5	5	3	3
3	3	3	3	3	3	5	3	3
3	3	3	3	3	3	3	3	3
2	2	3	2	2	3	3	2	2
2	4	3	2	2	3	5	3	3
3	3	3	3	3	3	3	3	3
3	4	4	3	3	3	4	3	3
1	4	3	4	4	4	5	2	4
3	2	5	3	3	5	4	5	1
3	1	5	1	1	3	5	3	5
3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3
3	3	3	3	1	3	5	3	3
2	4	4	5	4	5	4	2	4
4	2	4	1	2	5	5	3	3
3	3	3	3	3	3	3	3	3
3	3	3	3	2	5	4	2	3
3	2	2	3	2	3	4	1	3
3	3	3	3	2	2	4	2	3
2	2	4	2	2	4	4	3	3
1	1	3	4	4	5	5	1	5
3	4	3	4	4	4	4	5	5

CVD: Happiness (1) and Sadness (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
2	3	2	3	2	3	4	3	3
3	3	3	3	3	3	4	3	3
3	3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2	2
1	3	3	2	1	1	3	1	1
2	3	3	4	4	5	2	2	1
3	3	3	3	3	3	3	3	3
4	4	3	3	3	2	4	2	3
3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	4	3	3
3	3	3	3	4	4	3	3	3
1	3	3	3	4	4	5	3	3
1	2	1	1	2	2	2	1	1
2	4	5	2	2	3	5	2	3
1	2	4	2	4	3	4	2	4
1	2	3	1	1	1	1	1	1
4	3	4	3	3	1	4	4	3
3	3	3	3	3	3	3	3	3
4	2	3	3	3	4	4	3	3
2	3	3	3	3	3	4	1	3
3	3	3	3	3	3	3	3	3
4	4	3	2	3	1	5	1	3
3	3	3	3	3	3	3	3	3
3	2	3	2	1	4	5	2	3
1	1	3	4	2	5	4	2	5
2	3	4	3	5	3	5	1	3
2	3	3	3	3	3	4	4	3
3	2	2	3	3	3	4	3	3
3	3	3	3	3	3	3	3	3
3	2	3	2	3	3	5	2	3
2	2	2	2	4	5	5	3	3
1	2	4	3	3	3	5	1	5
4	4	5	1	2	2	5	1	5
3	3	3	3	3	3	3	3	3
2	3	3	3	3	4	4	3	3

CVD: Happiness (1) and Sadness (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
3	4	5	2	1	3	3	3	3
2	2	3	3	2	3	3	4	3
3	3	2	3	3	3	3	3	3
2	2	2	2	1	2	2	2	2
2	2	1	2	2	2	1	2	2
2	2	1	4	5	5	4	5	5
2	3	1	4	1	1	1	2	1
3	2	3	2	1	4	2	4	3
2	2	2	2	1	4	5	4	2
3	1	2	1	1	4	1	5	3
2	2	1	1	1	4	2	5	1
3	2	1	2	2	4	3	3	5
1	1	1	2	2	2	1	2	2
2	1	3	3	1	4	2	3	4
2	4	1	3		5	2	5	4
4	2	2	5	3	1	1	1	1
2	3	1	3	1	5	2	5	2
1	3	3	1	1	3	1	5	3
3	2	2	3	3	4	3	4	3
2	1	2	4	2	3	4	3	3
3	3	1	3	1	2	2	3	3
2	1	2	4	3	4	1	4	3
3	3	3	3	3	3	3	3	3
2	3	3	4	2	4	3	3	2
2	1	1	2	2	4	4	5	5
1	2	1	4	3	3	1	3	3
3	2	1	1	2	4	3	3	3
3	2	2	2	2	3	2	3	3
3	3	3	3	3	4	3	3	3
2	2	1	2	3	4	2	5	3
2	4	1	1	5	5	2	4	3
3	2	1	2	1	4	2	5	2
3	2	1	3	2	4	1	5	2
3	3	3	3	3	3	3	3	3
3	3	1	2	2	4	3	4	3

CVD: Peaceful (1) and Aggressive (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
3	1	1	1	2	2	3	3	3
4	2	3	1	1	3	2	2	1
3	3	3	3	3	3	3	3	3
3	2	2	2	2	2	2	1	2
3	2	2	2	1	1	1	1	2
4	2	4	4	2	4	5	1	5
3	4	3	4	1	1	1	1	1
2	4	4	3	1	2	4	3	3
5	4	5	2	1	4	5	1	2
4	2	2	1	1	3	1	5	3
5	4	2	1	1	3	5	5	1
4	2	2	1	1	2	4	2	1
2	2	2	1	1	1	2	1	1
4	2	5	2	1	1	3	4	2
5	4	5	3	1	2	5	3	4
2	4	2	5	2	2	2	1	1
2	3	1	1	1	5	1	5	3
5	2	3	1	1	3	2	4	3
2	3	2	2	2	2	3	4	2
4	2	1	2	1	5	4	4	2
4	2	4	2	1	2	4	4	3
4	2	1	2	2	4	1	4	2
3	3	3	3	3	3	3	3	3
5	4	4	2	1	3	4	2	2
5	4	5	1	1	4	5	5	1
3	2	3	3	1	3	4	4	2
5	2	3	1	2	5	3	2	2
4	3	4	1	1	1	4	3	2
4	3	5	1	2	3	3	3	3
5	2	2	2	2	3	2	3	1
5	4	1	1	2	1	4	1	1
5	3	1	2	1	1	3	4	2
5	4	1	2	1	2	2	1	1
3	3	3	3	3	3	3	3	3
4	3	2	1	2	3	2	3	3

CVD: Natural (1) and Synthetic (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
4	2	3	1	1	4	4	3	3
3	2	3	1	1	3	5	2	3
3	3	3	3	3	3	3	3	3
2	2	1	2	2	2	2	3	2
3	2	2	3	1	3	3	1	1
3	4	5	2	2	5	5	1	2
4	4	3	4	1	1	1	1	1
4	2	4	3	1	2	5	3	3
5	5	5	2	1	4	5	4	5
4	5	1	1	1	3	4	5	5
5	4	2	1	1	4	5	5	1
3	3	2	4	2	4	5	3	3
2	1	2	1	1	2	2	2	2
5	1	5	1	1	5	5	4	5
1	2	2	2	5	4	5	3	5
5	4	2	4	2	2	3	1	2
1	4	5	1	1	4	2	1	1
1	4	3	2	2	5	1	5	3
4	3	3	2	2	4	4	3	4
5	4	3	1	1	4	2	5	3
3	1	2	2	3	3	4	3	4
3	4	4	1	2	4	2	3	3
3	3	3	3	3	3	3	3	3
5	1	4	1	1	2	5	2	3
5	4	2	2	1	5	5	5	1
4	1	2	1	1	4	5	5	5
3	2	3	1	2	5	4	2	2
4	4	4	2	2	2	5	1	3
3	3	4	1	3	3	3	3	3
3	4	2	1	2	4	5	3	2
1	2	1	1	2	2	2	1	3
5	2	4	1	3	2	5	1	1
5	4	2	2	1	4	5	5	1
3	3	3	3	3	3	3	3	3
4	4	3	2	2	4	4	3	3

CVD: Warm (1) and Cold (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
3	2	3	3	4	4	4	3	3
1	2	3	3	4	5	4	4	4
3	3	2	3	3	3	3	3	3
1	2	1	2	1	2	2	1	2
1	1	1	2	3	3	1	2	2
1	2	2	4	5	5	2	3	4
2	3	2	3	2	2	2	3	3
1	2	3	4	5	4	3	3	3
1	1	1	4	5	2	5	4	5
1	2	1	2	4	5	4	5	5
1	2	2	3	4	4	4	5	1
1	1	1	3	4	3	3	3	4
1	1	2	1	2	2	1	2	2
1	2	1	3	5	4	3	3	5
1	1	1	2	5	5	5	5	1
3	3	1	3	2	2	3	1	1
1	3	1	2	3	5	4	5	5
1	3	3	5	5	3	1	3	3
1	2	2	3	4	4	3	3	4
2	3	2	3	4	4	4	3	4
1	4	1	2	2	2	2	2	4
1	2	3	4	5	4	4	4	3
2	3	3	3	4	3	4	2	3
1	2	2	2	4	4	2	3	4
1	2	2	2	4	4	5	5	4
1	1	2	4	2	2	1	2	5
3	1	2	2	2	3	3	3	4
3	2	1	4	5	5	2	3	3
5	4	3	3	3	3	3	5	5
2	2	2	2	4	4	4	4	5
1	2	2	4	5	5	3	3	2
1	2	1	3	5	5	3	3	4
1	2	2	4	5	4	4	5	4
3	3	3	3	3	3	3	3	3
1	2	2	3	3	4	4	3	3

CVD: Clean (1) and Dirty (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
1	3	2	2	1	3	1	3	3
2	3	2	2	1	3	2	1	2
3	3	3	3	3	3	3	3	3
2	2	2	3	2	2	2	2	2
2	2	1	3	2	2	1	2	1
3	3	2	2	2	1	5	1	1
3	4	3	4	1	3	3	3	1
3	2	2	2	1	2	2	3	2
3	3	3	1	1	3	3	3	1
3	5	2	2	2	4	3	5	1
3	3	3	1	1	3	3	5	1
3	2	1	1	1	3	3	1	1
2	2	1	1	1	1	2	1	1
3	4	4	4	1	5	3	2	1
4	4	4	4	1	2	1	2	1
5	5	2	2	1	1	2	2	4
2	3	1	1	1	4	2	5	1
1	4	3	1	1	1	1	3	3
3	4	4	2	2	2	4	3	2
4	1	1	4	1	2	3	4	3
2	4	2	4	2	2	2	3	3
3	4	3	4	3	4	2	2	1
3	3	3	3	3	3	4	3	3
2	4	1	3	2	5	2	2	1
1	1	4	5	1	4	5	5	1
4	3	1	5	1	2	3	5	1
3	2	2	1	2	3	2	3	2
5	4	2	1	1	1	3	1	1
3	3	3	2	3	3	3	3	3
4	4	2	2	2	3	3	4	1
2	4	2	2	1	4	4	3	1
5	4	1	4	1	4	1	5	1
4	3	2	3	1	2	2	5	1
3	3	3	3	3	3	3	3	3
3	4	2	3	2	4	3	3	1

CVD: Busy (1) and Simple (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
4	5	5	3	5	2	2	3	3
4	3	4	3	4	3	4	3	4
3	3	3	3	3	3	3	3	3
2	2	2	3	2	2	2	2	2
1	2	2	2	2	3	2	2	3
1	2	4	4	5	5	3	5	5
5	2	2	2	5	5	5	5	5
3	5	4	4	5	4	1	5	5
2	2	3	4	5	3	3	4	5
2	1	2	5	5	4	4	1	5
1	2	3	4	5	3	3	1	5
5	4	5	4	4	2	2	5	5
1	2	1	2	2	1	1	2	2
5	3	5	2	5	1	4	2	4
3	3	3	5	5	2	1	4	2
2	5	2	2	5	1	3	1	3
2	5	5	5	5	1	3	5	5
5	4	3	4	4	3	5	4	3
2	2	4	3	4	2	2	3	4
1	4	5	4	5	2	4	5	5
3	4	2	3	4	3	2	4	5
3	2	2	3	4	2	2	5	5
3	3	3	3	3	3	3	3	3
1	2	2	4	4	3	1	3	5
5	5	2	2	5	2	1	5	5
2	4	2	2	5	1	1	1	5
2	5	4	4	4	1	2	4	4
2	2	4	2	4	4	2	5	5
1	3	3	3	3	3	3	5	5
3	3	4	2	2	2	2	4	5
3	1	2	4	4	4	2	3	5
2	3	5	4	5	3	5	2	5
2	4	4	4	4	2	2	3	5
3	3	3	3	3	2	2	3	5
2	2	2	4	4	2	3	3	5

CVD: Trust (1) and Distrust (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
3	2	2	1	2	3	2	3	3
3	3	3	2	3	3	2	2	2
3	3	3	3	3	3	3	3	3
2	2	2	2	2	3	2	1	2
2	2	1	2	2	2	2	2	2
5	4	3	2	1	4	4	2	5
3	3	3	3	3	3	3	3	3
4	2	3	5	1	3	4	4	3
3	3	3	3	1	3	5	2	3
4	3	3	3	3	3	3	5	3
4	4	3	1	2	4	5	5	1
3	2	1	3	2	4	4	3	3
2	1	1	1	1	1	2	2	1
1	3	3	2	1	4	2	4	2
5	4	4	4	2	4	4	4	4
1	3	2	3	5	1	2	1	1
4	5	5	5	5	2	3	5	3
3	3	3	3	3	3	3	3	3
2	4	3	2	2	3	4	3	3
4	3	2	2	2	4	5	4	3
3	3	3	2	2	3	3	2	3
4	4	3	2	2	4	2	4	3
3	3	3	3	3	3	3	3	3
4	4	3	2	2	4	3	2	2
1	2	4	1	2	1	5	4	1
3	1	3	5	1	4	3	3	3
4	2	2	4	2	4	3	2	3
4	3	4	3	2	2	4	3	3
4	3	3	2	3	3	3	3	3
3	3	2	3	2	3	4	4	2
2	4	3	2	1	5	3	3	3
4	3	2	2	1	3	1	5	2
4	2	1	4	2	5	2	5	1
5	3	3	3	3	2	2	5	5
4	3	2	3	2	3	3	4	3

CVD: High Quality (1) and Low Quality (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
3	1	4	1	1	2	3	3	2
3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2	2
2	2	2	3	2	1	2	1	2
3	4	2	2	3	1	2	1	1
3	4	3	3	3	3	3	3	3
3	3	4	3	2	2	3	3	3
3	3	3	3	3	3	3	2	3
4	3	3	3	3	3	3	3	3
5	4	3	1	1	3	4	5	1
1	2	1	2	3	3	4	3	3
2	2	2	1	1	1	2	1	1
4	2	3	3	3	2	3	2	3
3	3	4	4	2	2	3	2	2
5	3	4	3	5	3	1	1	1
2	4	4	5	5	1	2	5	3
1	1	3	1	1	1	2	2	3
4	4	3	4	2	3	4	3	2
5	2	1	1	2	2	2	4	2
2	2	2	2	3	3	3	2	3
2	4	3	3	3	3	2	3	2
3	3	3	3	3	3	3	3	3
3	4	4	2	2	2	2	1	3
	1	4	1	1	2	4	4	1
1	3	4	5	2	2	1	5	2
4	2	2	2	2	4	3	2	3
4	4	5	2	2	3	3	3	3
3	3	3	2	2	3	3	3	3
4	4	3	3	3	3	4	2	2
2	4	2	1	1	2	3	3	3
5	3	1	3	1	4	3	5	1
3	3	2	4	2	3	3	1	1
3	3	3	3	3	3	3	3	3
2	3	2	3	2	2	3	3	3

CVD: Masculine (1) and Feminine (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
2	3	2	3	2	3	4	3	3
3	3	3	3	3	3	4	3	3
3	3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2	2
1	3	3	2	1	1	3	1	1
2	3	3	4	4	5	2	2	1
3	3	3	3	3	3	3	3	3
4	4	3	3	3	2	4	2	3
3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	4	3	3
3	3	3	3	4	4	3	3	3
1	3	3	3	4	4	5	3	3
1	2	1	1	2	2	2	1	1
2	4	5	2	2	3	5	2	3
1	2	4	2	4	3	4	2	4
1	2	3	1	1	1	1	1	1
4	3	4	3	3	1	4	4	3
3	3	3	3	3	3	3	3	3
4	2	3	3	3	4	4	3	3
2	3	3	3	3	3	4	1	3
3	3	3	3	3	3	3	3	3
4	4	3	2	3	1	5	1	3
3	3	3	3	3	3	3	3	3
3	2	3	2	1	4	5	2	3
1	1	3	4	2	5	4	2	5
2	3	4	3	5	3	5	1	3
2	3	3	3	3	3	4	4	3
3	2	2	3	3	3	4	3	3
3	3	3	3	3	3	3	3	3
3	2	3	2	3	3	5	2	3
2	2	2	2	4	5	5	3	3
1	2	4	3	3	3	5	1	5
4	4	5	1	2	2	5	1	5
3	3	3	3	3	3	3	3	3
2	3	3	3	3	4	4	3	3

CVD: Masculine (1) and Feminine (5)

Red	Orange	Yellow	Green	Blue	Purple	Pink	Black	White
2	3	2	3	2	3	4	3	3
3	3	3	3	3	3	4	3	3
3	3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2	2
1	3	3	2	1	1	3	1	1
2	3	3	4	4	5	2	2	1
3	3	3	3	3	3	3	3	3
4	4	3	3	3	2	4	2	3
3	3	3	3	3	3	3	3	3
3	3	3	3	3	3	4	3	3
3	3	3	3	4	4	3	3	3
1	3	3	3	4	4	5	3	3
1	2	1	1	2	2	2	1	1
2	4	5	2	2	3	5	2	3
1	2	4	2	4	3	4	2	4
1	2	3	1	1	1	1	1	1
4	3	4	3	3	1	4	4	3
3	3	3	3	3	3	3	3	3
4	2	3	3	3	4	4	3	3
2	3	3	3	3	3	4	1	3
3	3	3	3	3	3	3	3	3
4	4	3	2	3	1	5	1	3
3	3	3	3	3	3	3	3	3
3	2	3	2	1	4	5	2	3
1	1	3	4	2	5	4	2	5
2	3	4	3	5	3	5	1	3
2	3	3	3	3	3	4	4	3
3	2	2	3	3	3	4	3	3
3	3	3	3	3	3	3	3	3
3	2	3	2	3	3	5	2	3
2	2	2	2	4	5	5	3	3
1	2	4	3	3	3	5	1	5
4	4	5	1	2	2	5	1	5
3	3	3	3	3	3	3	3	3
2	3	3	3	3	4	4	3	3